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(12) UK Patent Application

(19) GB (11) 2 257 467 (13) A

(43) Date of A publication 13.01.1993

(21) Application No 9213763.7

(22) Date of filing 29.06.1992

(30) Priority data

(31) 03057971

(32) 28.06.1991

(33) JP

(51) INT CL<sup>5</sup>  
E05B 65/20

(52) UK CL (Edition L)  
E2A AAR A101 A118 A401 A431  
U1S S1820 S1856

(56) Documents cited  
None

(58) Field of search  
UK CL (Edition K) E2A AAR  
INT CL<sup>5</sup> E05B

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(54) Antitheft type door lock system

(57) When a so-called antitheft operation is carried out by using a key plate or the like from outside a motor vehicle, a reversible electric motor 1 is energized to rotate a worm wheel 3 with a projection 3b which is thus brought into sliding engagement with an arm 12 of an antitheft lever 9, thereby to pivot the lever 9 from a cancelling position (fig 5) to an antitheft position (fig 2) in which an operation lever 6 synchronously movable with a locking-unlocking lever 102 of a door latch device 104 is locked in its locking position by the engagement of projection 66 of lever 6 in recess 9d of the lever 9.

FIG.2

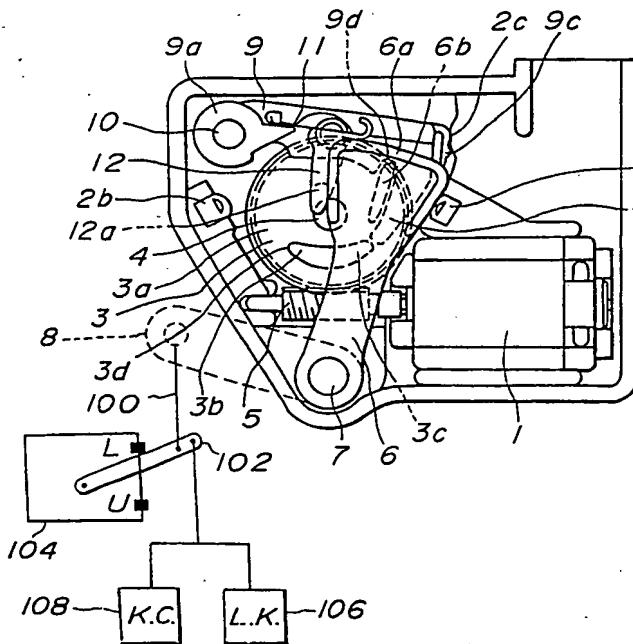
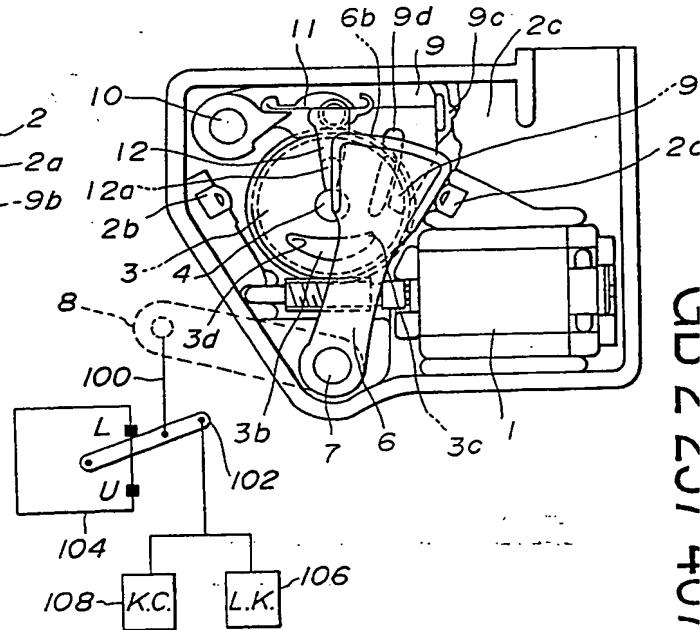
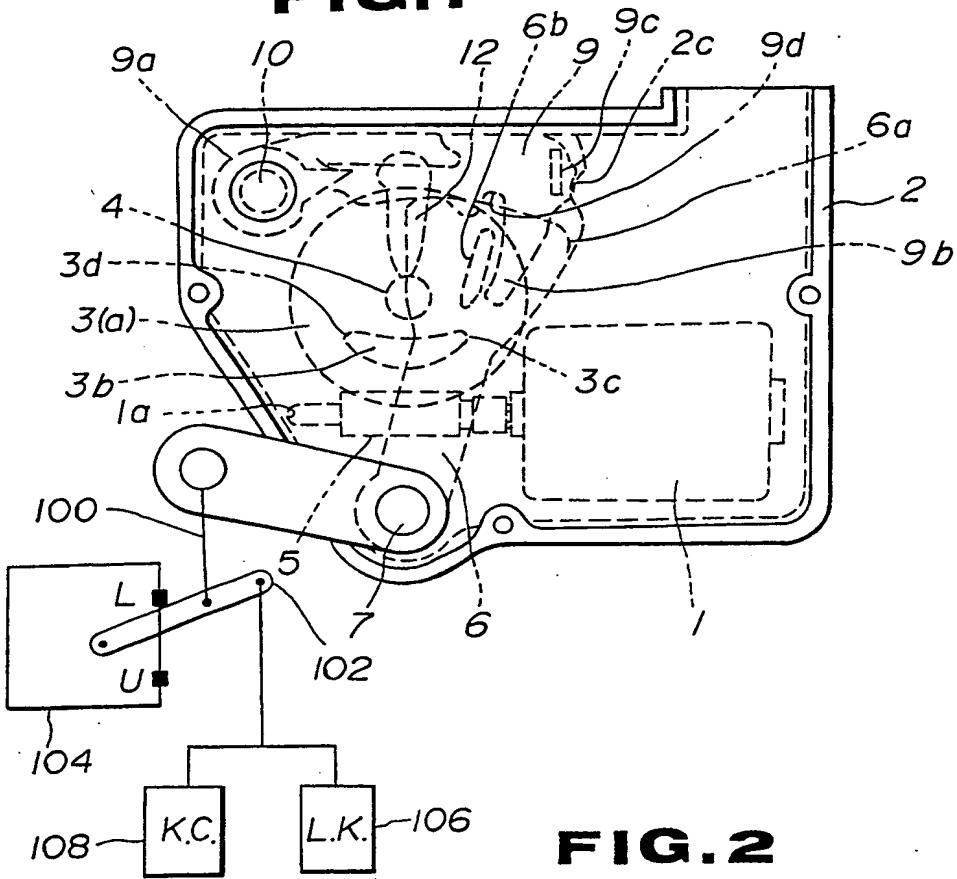
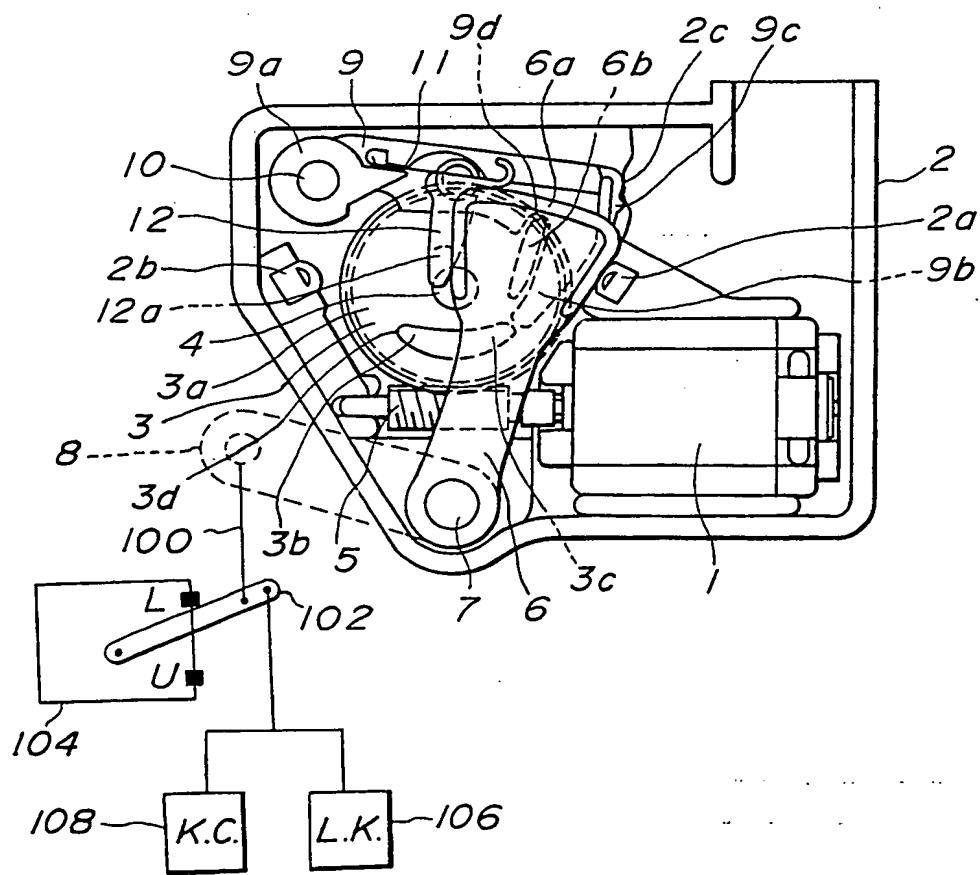
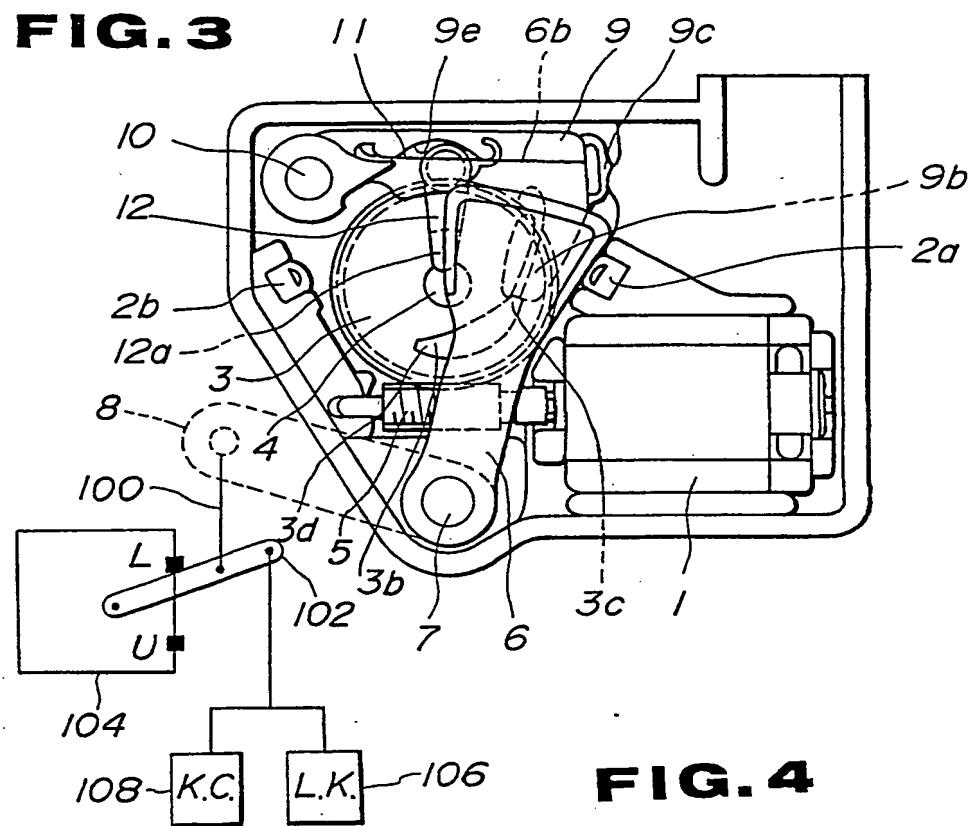


FIG.5

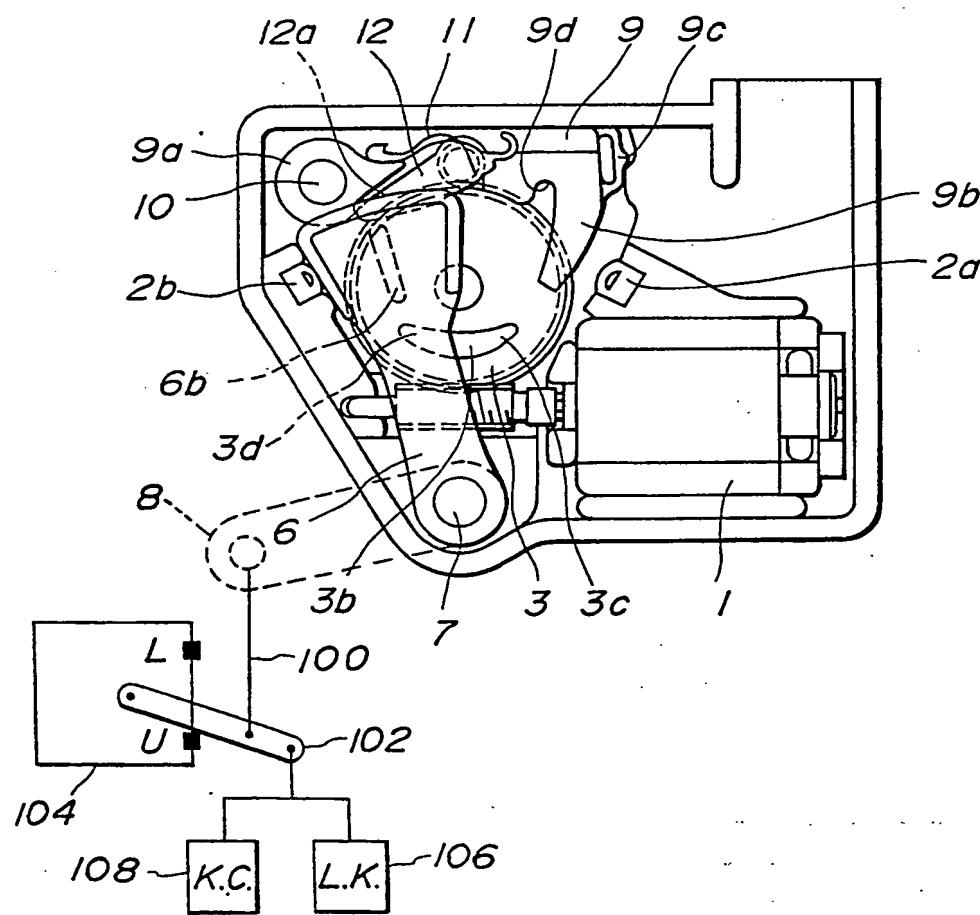


**FIG.1****FIG.2**

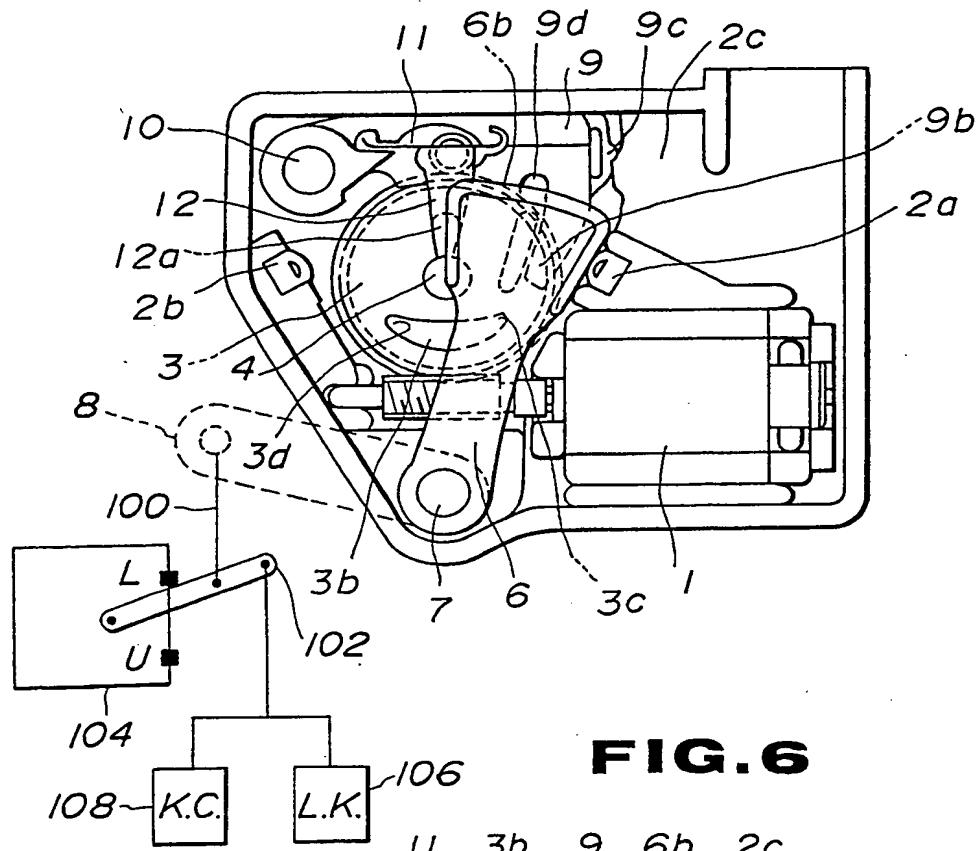
**FIG. 3**



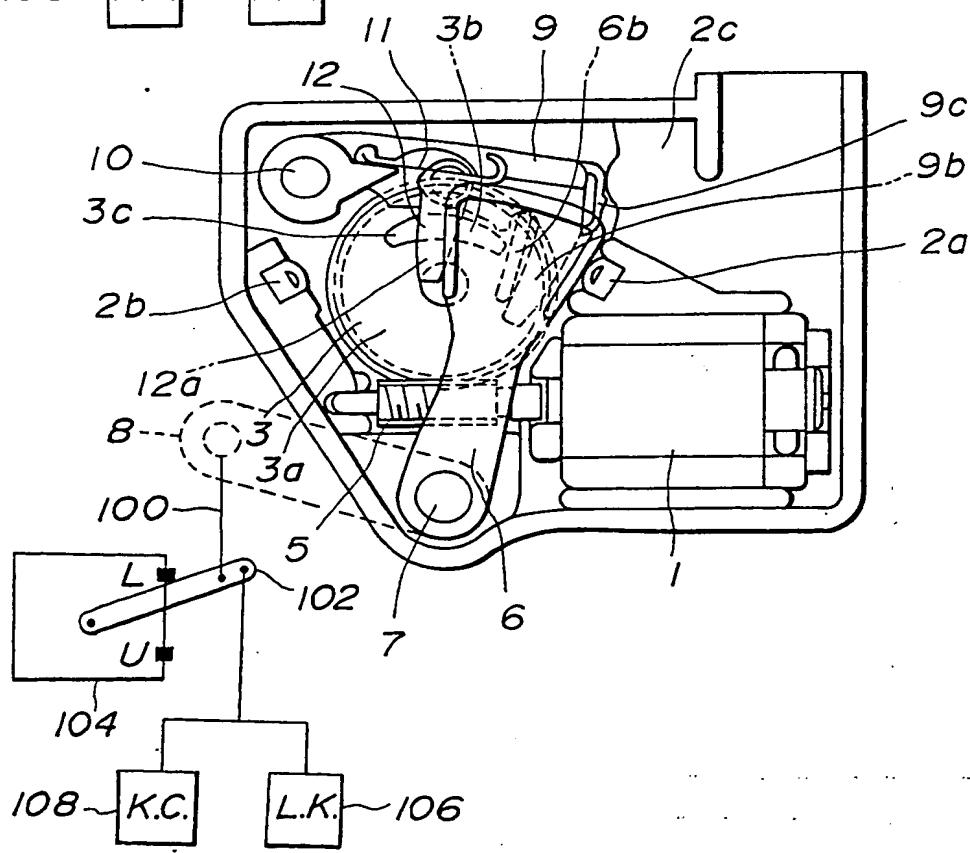
**FIG. 4**



**FIG. 5**



**FIG. 6**



## ANTITHEFT TYPE DOOR LOCK SYSTEM

The present invention relates in general to door lock systems for motor vehicles, and more particularly to door lock systems of a type which comprises a door latch device for latching and unlatching a door, locking means for locking the latching condition of the door latch device, a reversible electric motor for driving the door latch device and a control system for controlling the motor. More specifically, the present invention is concerned with door lock systems of a type having an antitheft mechanism which can protect a lock cancelling operation unjustly applied to the locked door latch device.

One of conventional door lock systems of the above-mentioned antitheft type is disclosed in Japanese Patent First Provisional Publication 55-65681.

The door lock system comprises generally a door latch device with a locking-unlocking lever, a rack member connected with the locking-unlocking lever, a first electric motor for driving the rack member to effect a locking or unlocking operation of the door latch device, a key cylinder switch for sensing an operation of a key cylinder mounted in the door, a lock pawl engageable with the rack member, and a second electric motor for actuating the lock pawl.

When the door is pivoted to its fully closed position, the door latch device latches the door to the vehicle body. When, thereafter, a lock control switch installed in a vehicle cabin is manipulated, the first electric motor is

energized to drive the rack member in a direction to achieve a locked condition of the door latch device.

when, with the door latched by the 5 door latch device, the key cylinder is manipulated by a key from outside the vehicle, the door latch device is locked and at the same time, due to operation of the key cylinder switch, the second electric motor is energized to 10 bring the lock pawl into a locked engagement with the rack member. With this, the rack member is locked and thus the rack member is suppressed from moving in the lock cancelling direction even when unjustly pushed in such direction by a pick 15 or the like.

However, due to usage of two (viz., first and second) electric motors, the entire system is complicated in construction and production cost of the same is inevitably high 20

What is desired is an antitheft type door lock system which is simple in construction and can be produced economically.

According to the present invention, there is 25 provided an antitheft type door lock system in which only one electric motor is used for achieving both the locking and unlocking operation and the antitheft operation.

According to one aspect of the present 30 invention, there is provided a door lock system which comprises a door latch device having a locking-unlocking lever, the door latch device being locked and unlocked when the locking- 35 unlocking lever assumes lock and unlock positions respectively; and an electric actuator including a reversible electric motor; a rotating member

driven by the motor to rotate in both directions; a first portion defined by the rotating member; a pivotal operation lever linked to the locking-unlocking lever thereby to assumes locking and 5 unlocking positions when the locking-unlocking lever assumes the lock and unlock positions respectively; a second portion defined by the operation lever and engageable with the first portion to pivot the operation lever to the locking and unlocking positions when the rotating 10 member rotates in both directions; a antitheft lever pivotal between an antitheft position wherein the operation lever in the locking position is locked and a cancelling position 15 wherein the operation lever in the locking position is permitted to pivot toward the unlocking position; a third portion defined by the antitheft lever and engageable with the first portion to pivot the antitheft lever from the antitheft position to the cancelling position; a fourth portion defined by the antitheft lever and 20 lockingly engaged with the second portion when the antitheft lever comes to the antitheft position; an arm lever pivotally held by the antitheft lever; and a fifth portion defined by 25 the arm lever and engageable with the first portion to pivot the antitheft lever from the cancelling position to the antitheft position.

According to a second aspect of the present 30 invention, there is provided a door lock system which comprises a door latch device having a locking-unlocking lever, the door latch device being locked and unlocked when the locking-unlocking lever assumes lock and unlock positions 35 respectively; a reversible electric motor; a rotating member driven by the electric motor to rotate in both direction; a pivotal operation

lever linked to the locking-unlocking lever, the operation lever assuming locking and unlocking positions when the locking-unlocking lever assumes the lock and unlock positions

5 respectively; an antitheft lever pivotal between an antitheft position and a cancelling position, the antitheft position being a position wherein the operation lever in the locking position is locked, the cancelling position being a position

10 wherein the operation lever in the locking position is permitted to pivot toward the unlocking position; first means for pivoting the operation lever to the locking and unlocking positions when the rotating member rotates from

15 its neutral position in first and second directions respectively; second means for pivoting the antitheft lever from the antitheft position to the cancelling position when the rotating member rotates from its neutral position

20 in the second direction; third means for locking the operation lever in the locking position when the antitheft lever is pivoted from the cancelling position to the antitheft position; and fourth means for pivoting the antitheft lever

25 from the cancelling position to the antitheft position when the rotating member rotates in the first direction.

Preferred features and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a front view of an essential part of the door lock system of a preferred embodiment of the invention;

Fig. 2 is a view similar to Fig. 1 but with a case lid removed, showing a state wherein a

antitheft condition of a door latch device is established;

Fig. 3 is a view similar to Fig. 2, but showing a state wherein a lock cancelling 5 operation is being carried out;

Fig. 4 is a view similar to Fig. 2, but showing a state wherein an unlocked condition of the door latch device is established;

Fig. 5 is a view similar to Fig. 2, but 10 showing a state wherein a locked condition of the door latch device is established; and

Fig. 6 is a view similar to Fig. 2, but showing a state wherein an antitheft operation is being carried out.

15 In the following, the door lock system of the present invention will be described in detail with reference to the accompanying drawings.

In the drawings, for example Fig. 1, denoted 20 by numeral 1 is a reversible electric motor installed in a case 2. The motor 1 has a drive shaft 1a on which a worm 5 is securely mounted. Meshed with the worm 5 is a worm wheel 3 which is rotatably disposed on a shaft 4 which extends 25 perpendicular to the axis of the drive shaft 1a. On a front surface 3a (as viewed in the drawing) of the worm wheel 3, there is integrally formed an arcuate projection 3b which is elongated in a circumferential direction. Longitudinal ends of 30 the projection 3b are denoted by numerals 3c and 3d, respectively. For the purpose which will be clarified hereinafter, the middle portion of the projection 3b is shaped to near the shaft 4.

Designated by numeral 6 is an operation 35 lever which is pivotally connected through a pivot shaft 7 to the case 2. The axis of the pivot shaft 7 is in parallel with the axis of the

shaft 4 of the worm wheel 3. A free end portion 6a of the operation lever 6 has at its back surface (as viewed in the drawing) a radially extending projection 6b which is engageable with 5 the arcuate projection 3b of the worm wheel 3.

As will become apparent as the description proceeds, due to rotation of the worm wheel 3 in normal (viz., clockwise) or reversed (viz., counterclockwise) direction, the operation lever 10 6 can assume a locking position as shown in Fig. 5 or an unlocking position as shown in Fig. 4. As shown in these drawings, when assuming the locking or unlocking position, the operation lever 6 abuts against a right or left 15 stopper 2a or 2b defined by the case 2.

Referring back to Fig. 1, denoted by numeral 8 is an output lever which is secured to the pivot shaft 7, so that the output lever 8 and the operation lever 6 pivot together with the pivot 20 shaft 7 like a single unit.

The output lever 8 is connected through a rod 100 to a locking-unlocking lever 102 of a door latch device 104. When the operation lever 6 assumes the locking position (see Fig. 5), the 25 locking-unlocking lever 102 assumes a lock position wherein a latching condition of the door latch device 104 is locked, and when the operation lever 6 is pivoted to the unlocking position (see Fig. 4), the locking-unlocking lever 102 is pivoted to an unlock position 30 wherein the locked condition of door latch device 104 is cancelled.

It is to be noted that the latching condition of the door latch device 104 means that 35 the door latch device 104 establishes a latched engagement of a fully closed door relative to the vehicle body, and the locked condition of the

door latch device 104 means that the latching condition of the door latch device 104 is locked. Thus, when the door latch device 104 is kept in the latching condition, the door can be opened by 5 only manipulating an outside or inside door handle, while, when the door latch device 104 is kept in the locked condition, the door can not be opened even when the outside or inside handle is manipulated. The door latch device of this type 10 is shown in US Patent No. 4,850,625 granted to Yasuaki HORI et al on July 25, 1989.

Although not shown in the drawings, a known switching means is employed for controlling operation of the motor 1. Due to function of 15 this switching means, the worm wheel 3 is automatically returned to its neutral position (as shown in Figs. 1, 2, 4, and 5) after moving the operation lever 6 to the locking or unlocking position. That is, when, due to operation of the 20 motor 1, the worm wheel 3 is rotated in normal or reversed direction from the neutral position, the arcuate projection 3b of the worm wheel 3 is brought into abutment with the projection 6b of the operation lever 6, thereby pivoting the lever 25 6 to the locking or unlocking position. Thereafter, due to function of the switching means, the motor 1 is reenergized to run in opposite direction to return the worm wheel 3 to the neutral position. Thus, usually, the worm 30 wheel 3 assumes the neutral position.

Denoted by numeral 9 is an antitheft lever which has a base portion 9a pivotally connected through a shaft 10 to the case 2. A free end of the 35 antitheft lever 9 is bent to form a hook-like arm 9b which extends toward the pivot shaft 7. The hook-like arm 9b has at its base portion a catching recess 9d which is sized to receive an

outside end of the projection 6b of the operation lever 6. The free end of the antitheft lever 9 has further a resiliently deformable member 9c which is resiliently engageable, in a snap action 5 manner, with a check projection 2c defined by the case 2.

As will be described in detail hereinafter, when, with the operation lever 6 kept in the locking position as shown in Fig. 2, the 10 antitheft lever 9 is pivoted downward to a antitheft position, getting over the check projection 2c, the catching recess 9d of the lever 9 receives therein the outside end of the projection 6b of the operation lever 6. Thus, 15 under this condition, the operation lever 6 can not pivot to the unlocking position even when applied with an external force from the door latch device 104, and thus, a so-called antitheft condition is established in the locked door latch 20 device 104. While, when the antitheft lever 9 is pivoted upward from the antitheft position to a cancelling position, getting over the check projection 2c, the catching recess 9d of the lever 9 releases the projection 6b of the 25 operation lever 6. Thus, under this condition, the operation lever 6 is permitted to pivot to the unlocking position when applied with an external force from the door latch device 104. Although not shown in the drawings, a spring is 30 associated with the antitheft lever 9 to bias the same toward the cancelling position.

In order to pivot the antitheft lever 9 to the antitheft position with an aid of the worm wheel 3, an arm lever 12 is further employed, 35 which has one end pivotally connected to a middle portion of the antitheft lever 9. The arm lever 12 is biased, by a flat spring 11, to assume a

raised neutral position which is perpendicular to the lever 9. The flat spring 11 has both ends hooked to grooves 9e formed in the antitheft lever 9. A free end of the arm lever 12 has at 5 its back surface a small projection 12a which protrudes toward the front surface 3a of the worm wheel 3. As will become apparent hereinafter, when, due to normal rotation of the worm wheel 3, the arcuate projection 3b (more specifically, the 10 curved inside wall of the same) of the worm wheel 3 is brought into sliding engagement with the small projection 12a, the antitheft lever 9 is pulled downward to the antitheft position.

In the following, operation of the door lock 15 system of the present invention will be described with reference to the drawings.

For ease of understanding, the description will be commenced with respect to the locked condition of the door lock system as shown in 20 Fig. 5.

Under this condition, the operation lever 6 assumes the locking position and the locking-unlocking lever 102 of the door latch device 104 assumes the afore-mentioned lock position. That 25 is, the latching condition of the door latch device 104 is locked, so that the door can not be opened even when the outside or inside door handle is manipulated. The worm wheel 3 assumes the neutral position and the antitheft lever 9 30 assumes the cancelling position.

When, under this condition, a lock-knob 106 mounted on an inner side of the door is manipulated in a direction to cancel the locked condition of the door latch device 104, the 35 output lever 8 and thus the operation lever 6 can be pivoted in a counterclockwise direction from the locking position (Fig. 5) to the unlocking

position (Fig. 4). Thus, the locked condition of the door latch device 104 becomes cancelled, and thus the device 104 assumes the unlocked condition, so that the door can be opened by manipulating the outside or inside door handle. 5 During the pivoting of the operation lever 6, the projection 6b of the lever 6 is brought into abutment with the arm lever 12 to pivot the same in a clockwise direction against the biasing 10 force of the flat spring 11, as is understood from Fig. 4.

When now the lock-knob 102 is manipulated in a direction to establish the locked condition of the door latch device 104, the output lever 8 and thus the operation lever 6 can be pivoted in a clockwise direction from the unlocking position 15 (Fig. 4) to the locking position (Fig. 5). Due to this pivoting of the operation lever 6, the arm lever 12 is returned to its neutral position 20 as is understood from Fig. 5.

The above-mentioned pivoting of the operation lever 6 is also effected by a key which is manipulated to turn a key cylinder 108 mounted on the outer side of the door.

25 When, with the operation lever 6 assuming the unlocking position as shown Fig. 4, the motor 1 is energized to rotate the worm wheel 3 in a clockwise direction, the left end 3d of the arcuate projection 3b pushes the projection 6b of 30 the lever 6 and thus pivots the lever 6 to the locking position as shown in Fig. 5. When the operation lever 6 reaches the locking position, the switching means (not shown) functions to reenergize the motor 1 to run in opposite 35 direction. With this, the worm wheel 3 is returned to its neutral position as is seen from Fig. 5.

In the following, the antitheft operation will be described with reference to the drawings.

When, with the door lock system assuming the locking position as shown in Fig. 5, a so-called antitheft manipulation is carried out by using a key plate or other known means from outside of the vehicle, the motor 1 is energized to turn the worm wheel 3 in a clockwise direction, bringing the arcuate projection 3b of the wheel 3 into sliding engagement with the small projection 12a of the arm lever 12. Due to the above-mentioned unique shape of the arcuate projection 3b, the sliding engagement of the projection 3b with the small projection 12a induces downward pivoting of the antitheft lever 9 from the cancelling position to the antitheft position. Thereafter, due to function of the switching means, the motor 1 is reenergized to run in opposite direction to return the worm wheel 3 to its neutral position. Upon this, the system shows the condition as shown in Fig. 2 in which the projection 6b of the operation lever 6 is caught by the catching recess 9d of the antitheft lever 9. Thus, under this condition, the antitheft condition is established in the locked door latch device 104. That is, even when an external force is applied to the output lever 8, the operation lever 6 can not be pivoted to the unlocking position. Thus, lock cancelling operation unjustly applied to the locked door latch device 104 can be protected. That is, even when the output lever 8 or the locking-unlocking lever 102 of the door latch device 104 is unjustly pushed toward the unlocking position by a car thief handling a pick or the like, the operation lever 6 can not be pivoted to the unlocking position.

When, with the door lock system assuming the antitheft condition as shown in Fig. 2, unlocking manipulation is carried out by using the key plate or the other known means from outside of the vehicle, the motor 1 is energized to turn the worm wheel 3 in a counterclockwise direction (see Figs. 2 and 3). With this, the right end 3c of the arcuate projection 3b is brought into abutment with the leading end of the hook-like arm 9b of the antitheft lever 9, thereby pivoting the lever 9 upward from the antitheft position to the cancelling position, and then the right end 3c is brought into abutment with the projection 6b of the operation lever 6, thereby pivoting the lever 6 from the locking position to the unlocking position. Thereafter, due to function of the switching means, the motor 1 is reenergized to turn the worm wheel 3 to the neutral position. Upon this, the system shows the condition as shown in Fig. 4. Under this condition, the door can be opened by only manipulating the outside or inside door handle.

CLAIMS:

1. A door lock system comprising:  
a door latch device having a locking-unlocking lever, said door latch device being locked and unlocked when said locking-unlocking lever assumes lock and unlock positions respectively; and  
an electric actuator including a reversible electric motor; a rotating member driven by said motor to rotate in both directions; a first portion defined by said rotating member; a pivotal operation lever linked to said locking-unlocking lever thereby to assumes locking and unlocking positions when said locking-unlocking lever assumes said lock and unlock positions respectively; a second portion defined by said operation lever and engageable with said first portion to pivot said operation lever to said locking and unlocking positions when said rotating member rotates in both directions; a antitheft lever pivotal between an antitheft position wherein said operation lever in said locking position is locked and a cancelling position wherein said operation lever in said locking position is permitted to pivot toward said unlocking position; a third portion defined by said antitheft lever and engageable with said first portion to pivot said antitheft lever from said antitheft position to said cancelling position; a fourth portion defined by said antitheft lever and lockingly engaged with said second portion when said antitheft lever comes to said antitheft position; an arm lever pivotally held by said antitheft lever; and a fifth portion defined by said arm lever and engageable with said first portion to pivot said antitheft lever

from said cancelling position to said antitheft position.

2. A door lock system comprising:
  - 5 a door latch device having a locking-unlocking lever, said door latch device being locked and unlocked when said locking-unlocking lever assumes lock and unlock positions respectively;
  - 10 a reversible electric motor;
  - 15 a rotating member driven by said electric motor to rotate in both direction;
  - 20 a pivotal operation lever linked to said locking-unlocking lever, said operation lever assuming locking and unlocking positions when said locking-unlocking lever assumes said lock and unlock positions respectively;
  - 25 an antitheft lever pivotal between an antitheft position and a cancelling position, said antitheft position being a position wherein said operation lever in said locking position is locked, said cancelling position being a position wherein said operation lever in said locking position is permitted to pivot toward said unlocking position;
  - 30 first means for pivoting said operation lever to said locking and unlocking positions when said rotating member rotates from its neutral position in first and second directions respectively;
  - 35 second means for pivoting said antitheft lever from said antitheft position to said cancelling position when said rotating member rotates from its neutral position in said second direction;
  - 40 third means for locking said operation lever in said locking position when said antitheft

lever is pivoted from said cancelling position to said antitheft position; and

fourth means for pivoting said antitheft lever from said cancelling position to said antitheft position when said rotating member rotates in said first direction.

3. A door lock system as claimed in Claim 2, in which said first means comprises:

an arcuate projection formed on said rotating member; and

an elongate projection formed on a free end of said operation lever,

wherein when said rotating member is rotated, said arcuate projection is brought into abutment with said elongate projection to pivot said operation lever to either one of said locking and unlocking positions.

4. A door lock system as claimed in Claim 3, in which said second means comprises:

one end of said arcuate projection; and  
a hook-like arm possessed by said antitheft lever,

wherein when said rotating member is rotated in said second direction, said one end of said arcuate projection is brought into abutment with said hook-like arm to pivot said antitheft lever from said antitheft position to said cancelling position.

5. A door lock system as claimed in Claim 3 or 4, in which said third means comprises:

means defining a catching recess in said antitheft lever; and

one end of said elongate projection, said catching recess receiving therein said one end of

said elongate projection when said antitheft lever is pivoted to said antitheft position.

6. A door lock system as claimed in any of claims 3 to 5, in which said fourth means comprises:

an arm lever having one end pivotally connected to said antitheft lever;

a projection formed on the leading end of said arm lever; and

an inside wall of said arcuate projection, wherein when said rotating member is rotated in said first direction from its neutral position, said inside wall of said arcuate projection is slidably engaged with said projection to pull said antitheft lever from said cancelling position to said antitheft position.

7. A door lock system as claimed in any preceding claim, including a check device by which the pivoting of said antitheft lever between said antitheft position and said cancelling position can be made in a snap action manner.

8. A door lock system as claimed in Claim 7, in which said check device comprises:

a resiliently deformable member provided on said antitheft lever; and

a projection defined by a case, said resiliently deformable member being resiliently engageable with said projection upon pivoting of said antitheft lever.

9. A door lock system as claimed in any preceding claim, in which said rotating member is a worm wheel which is meshed with a worm disposed on a drive shaft of said motor.

10. A door lock system as claimed in Claim 6, in which the arm lever is biased, by a flat spring, to stand perpendicular to the antitheft lever.
11. A door lock system substantially as described with reference to, and as shown in, the accompanying drawings.

## Relevant Technical fields

(i) UK CI (Edition K ) E2A (AAR)

(ii) Int CI (Edition 5 ) E05B

## Databases (see over)

(i) UK Patent Office

(ii)

## Search Examiner

MR P SILVIE

## Date of Search

27 AUGUST 1992

Documents considered relevant following a search in respect of claims ALL

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

Category	Identity of document and relevant passages	Relevance to claim(s)

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